The Effect of Irrigation and Fertilization on Willow Productivity

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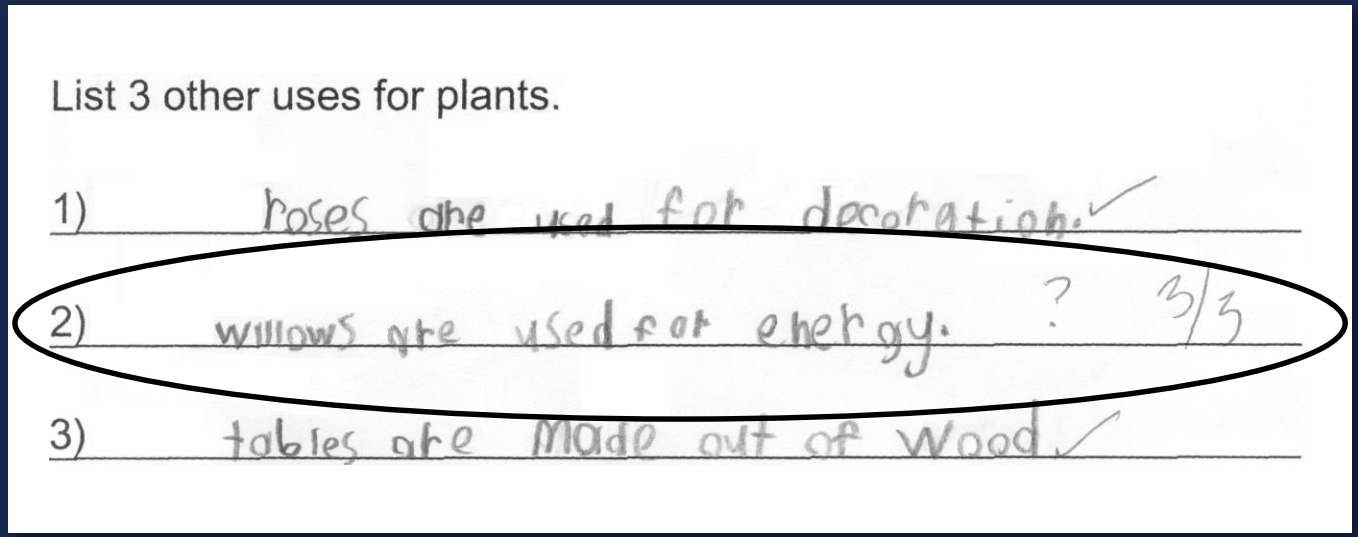
SASKATCHEWAN CENTRE FOR SOIL RESEARCH

Why Willow?



List 3 other uses for plants.

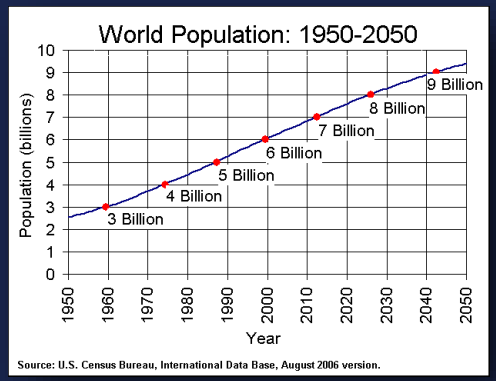
1) roses are used for decoration. ✓

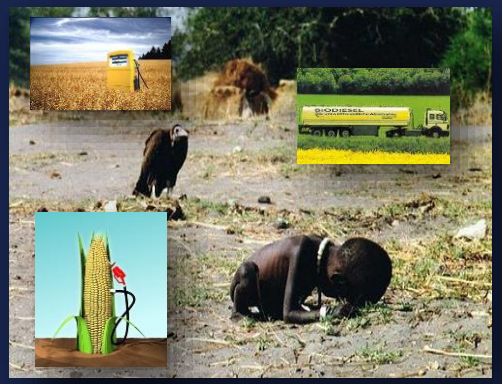
2) willows are used for energy. ? 3/3

3) tables are made out of wood. ✓

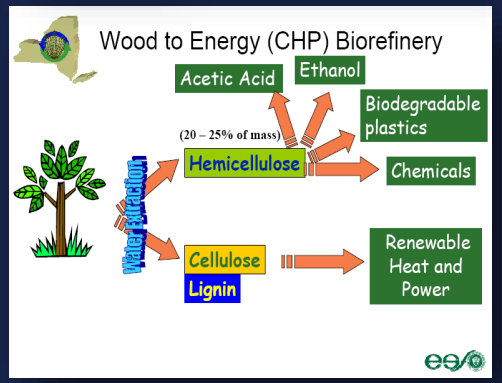
Why Willow: Triple Bottom Line

Social





Economic



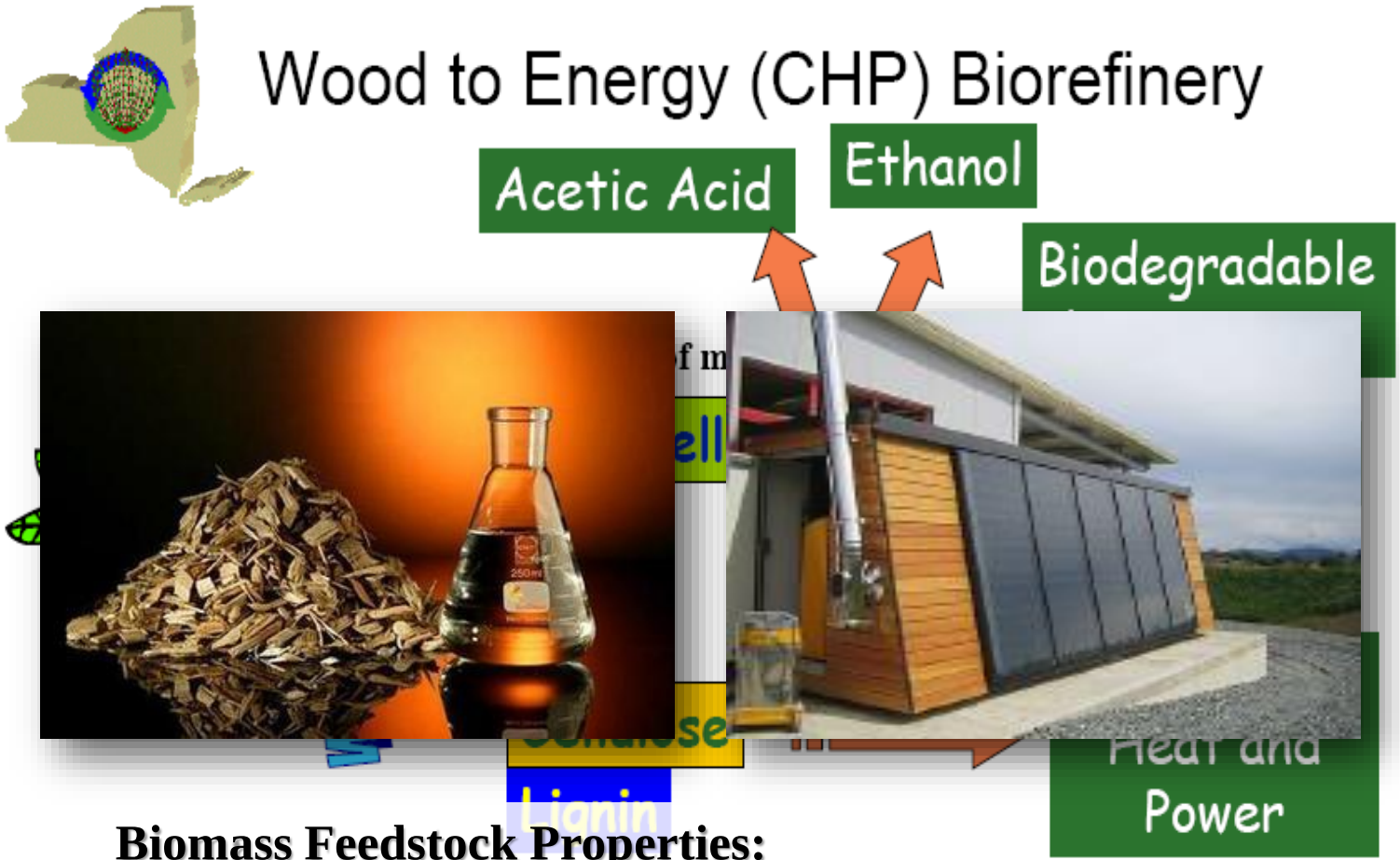
Environment

Speech from the Throne (October 21, 2009)

The Honourable Dr. Gordon L. Barnhart, Lieutenant Governor of Saskatchewan

…we need to look at all energy options – gas turbines, cogeneration, clean coal, wind, hydro, *biomass*, solar, import contracts and nuclear – to determine the best way to meet Saskatchewan's future energy needs in the most affordable, reliable, and environmentally-friendly manner.

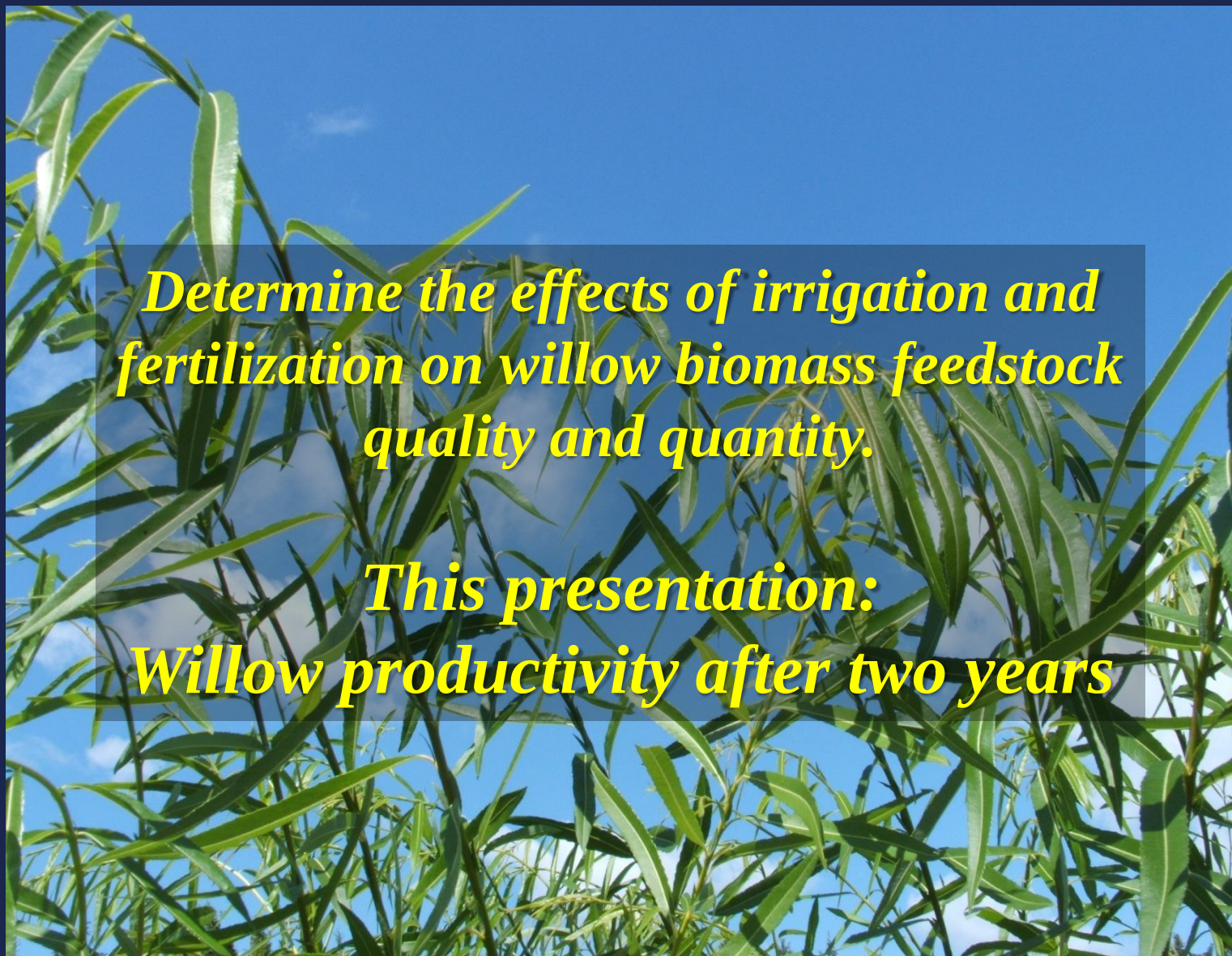
Wood Quality vs. Quantity



Biomass Feedstock Properties:

extractives ('pitch'); cellulose; hemicelluloses, and lignin; inorganic element content; specific gravity; calorific energy value; ratio of bark to wood; ash content; and moisture content.

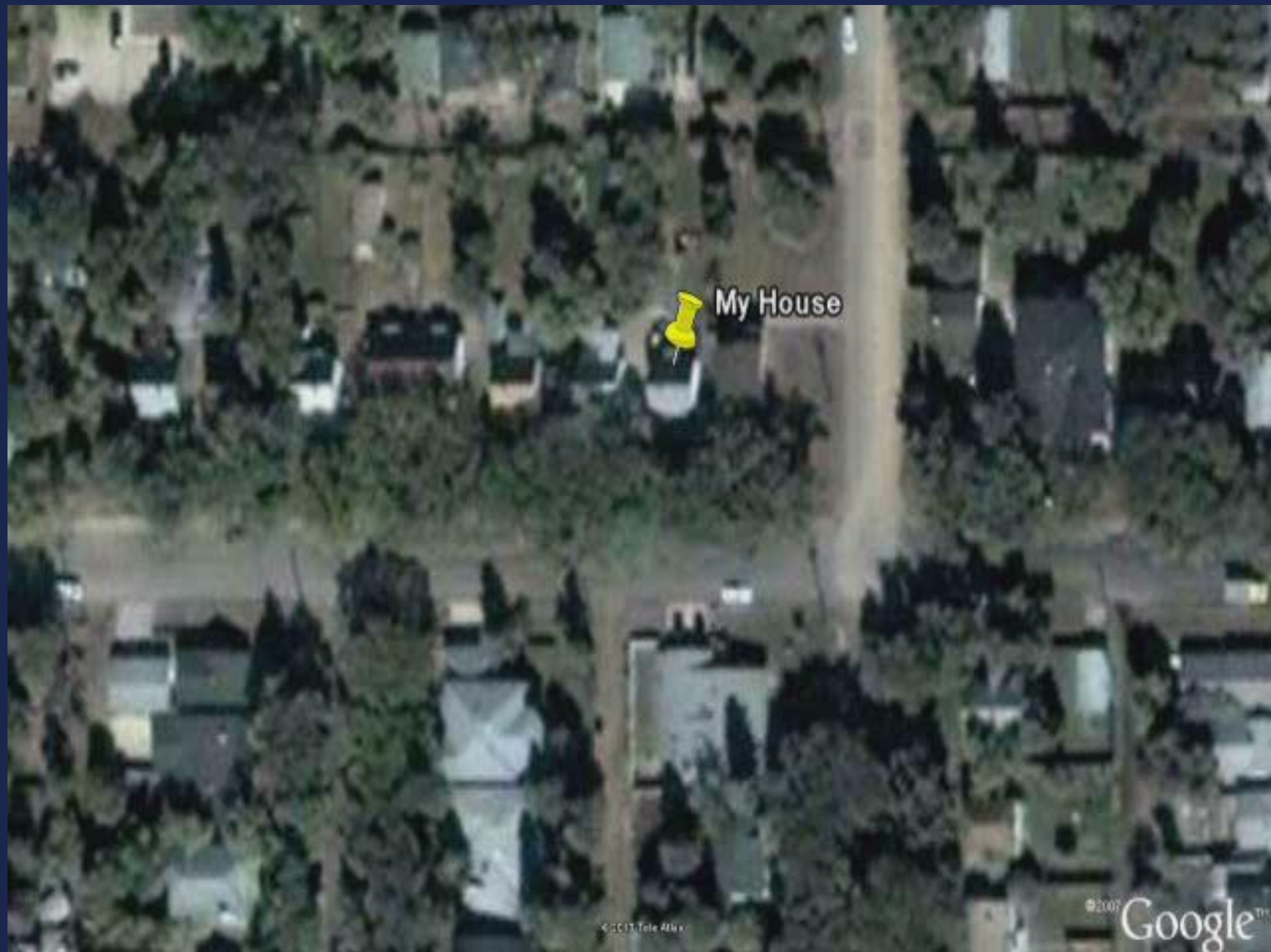
Objective



Determine the effects of irrigation and fertilization on willow biomass feedstock quality and quantity.

This presentation:
Willow productivity after two years

Study Site



Study Site

Study Site

Past management: barley/oats

Growing season precipitation:

2008 (165 mm)

2009 (201 mm)

Soil: Orthic Vertisol
Sutherland Association
Glacial lacustrine PM

Agriculture Capability Classification Rating: Class 2

Site Establishment

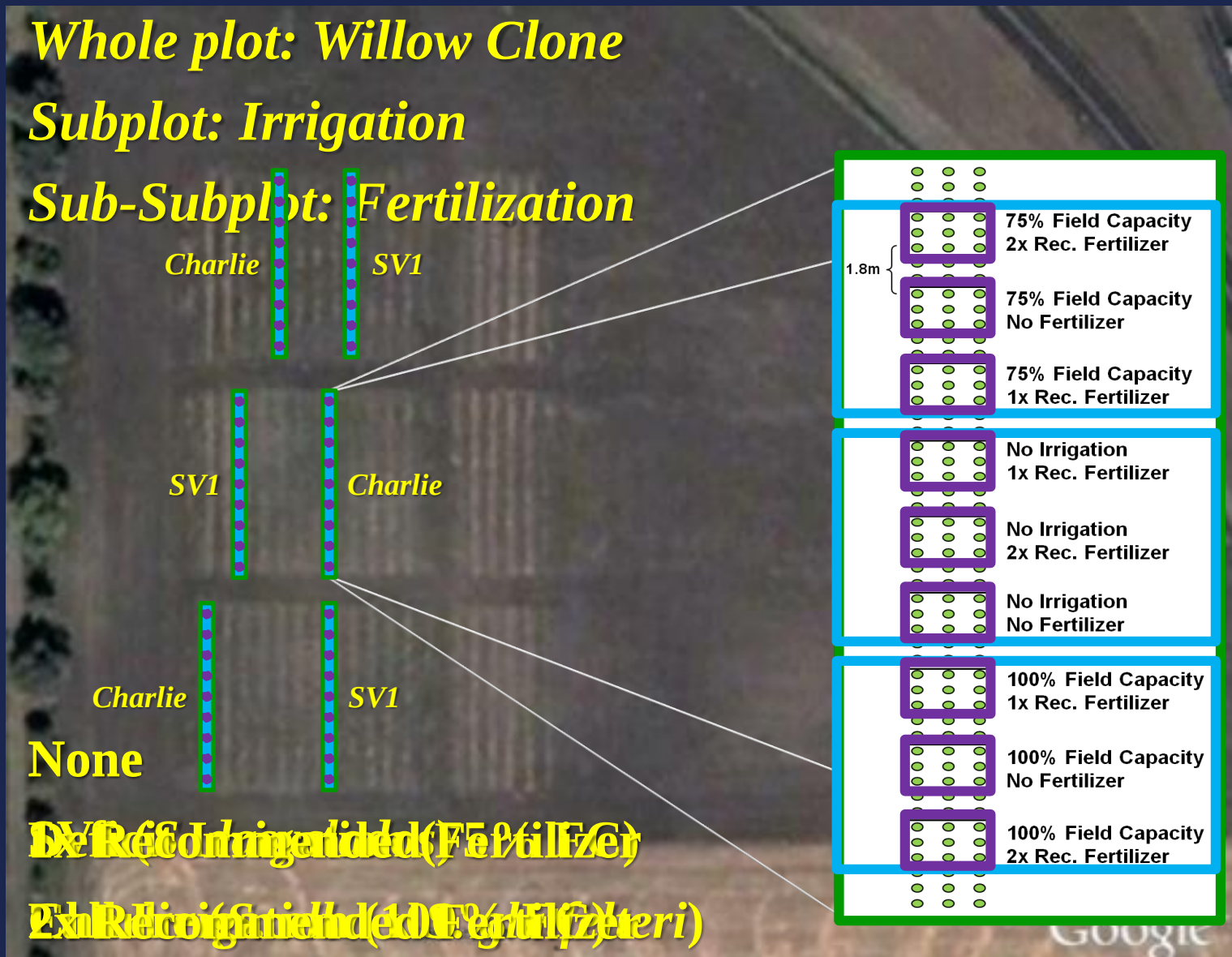
Experimental Design

(Split-Split-Plot)

Whole plot: Willow Clone

Subplot: Irrigation

Sub-Subplot: Fertilization



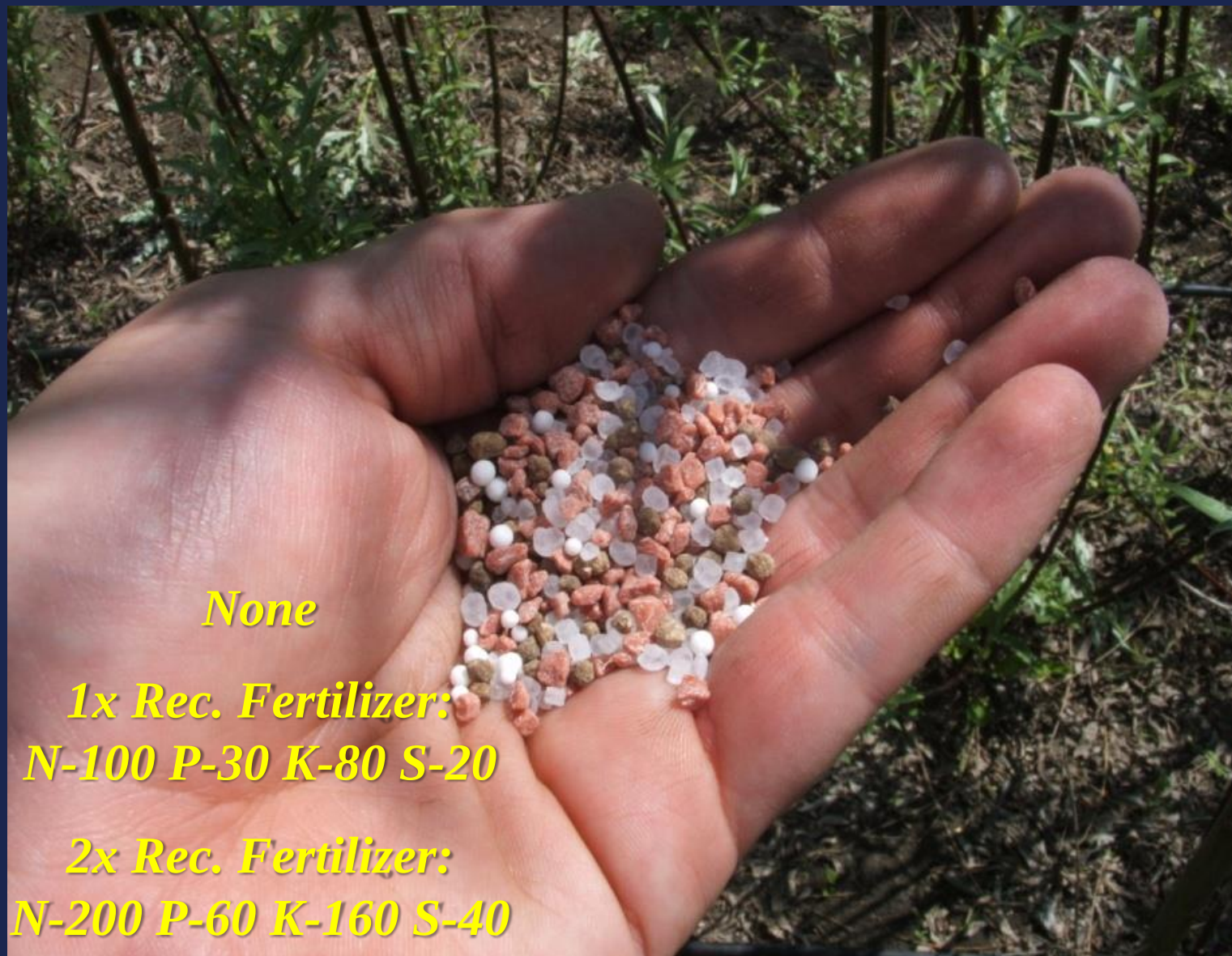
Controlling Irrigation Rates

Controlling Irrigation Rates

Drip Irrigation Precision

Effective Buffers

Fertilization Rates (kg/ha)



None

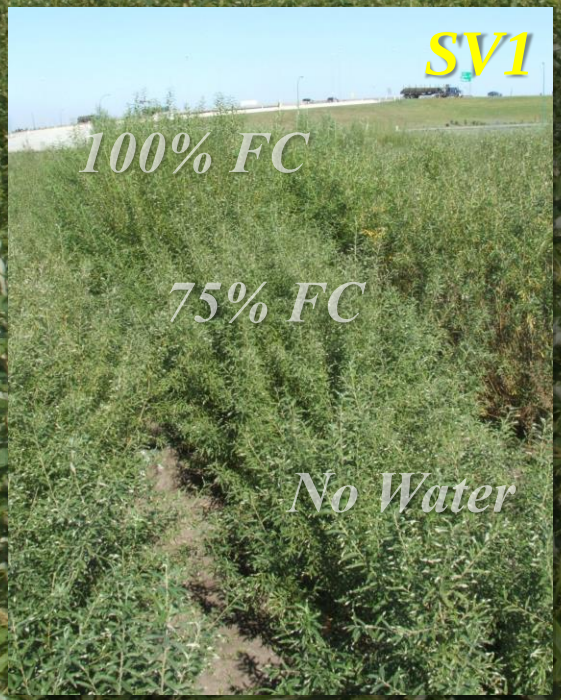
1x Rec. Fertilizer:
N-100 P-30 K-80 S-20

2x Rec. Fertilizer:
N-200 P-60 K-160 S-40

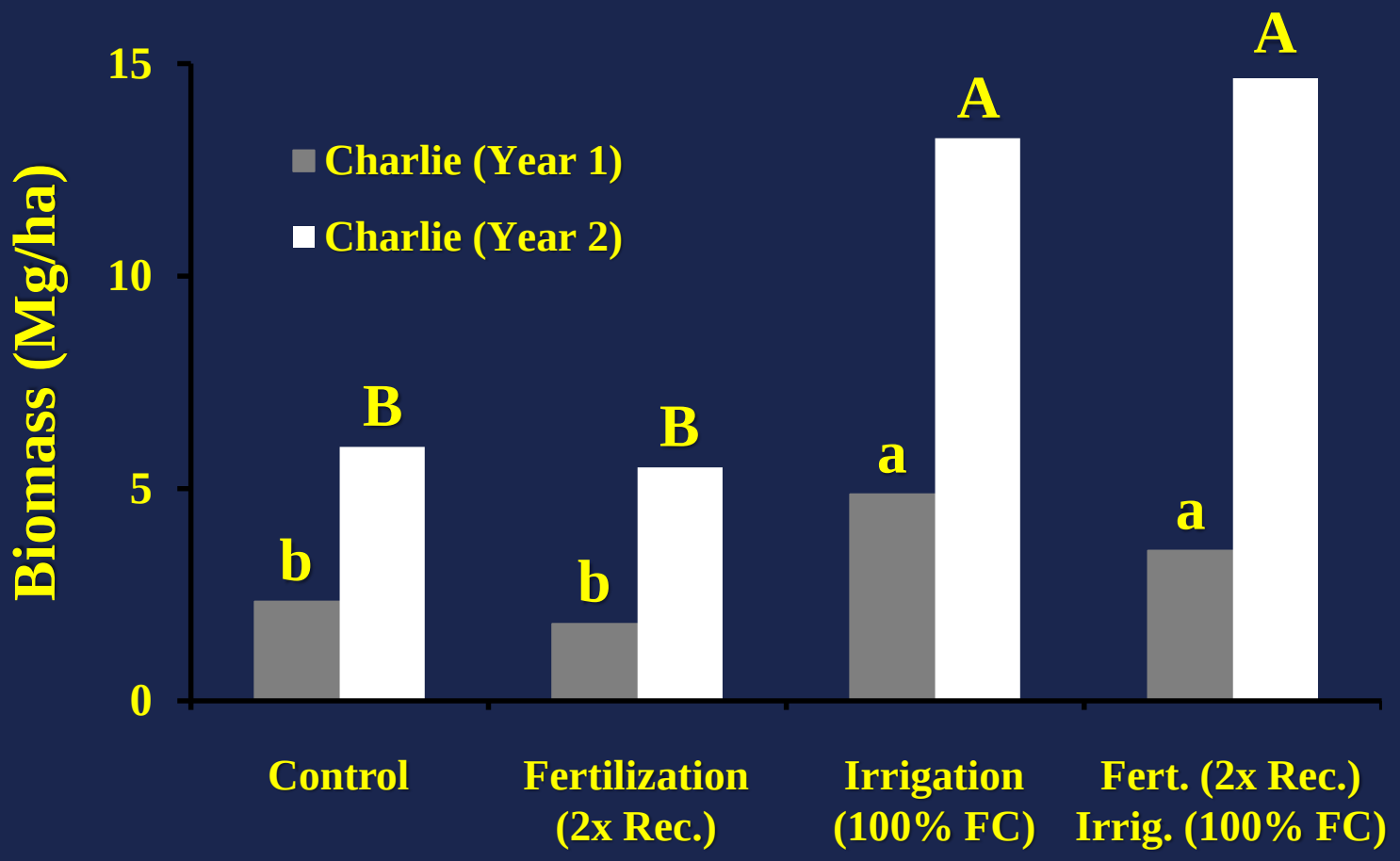
Site Maintenance

Plant Tissue Sampling

Results and Discussion:
Willow Biomass Production

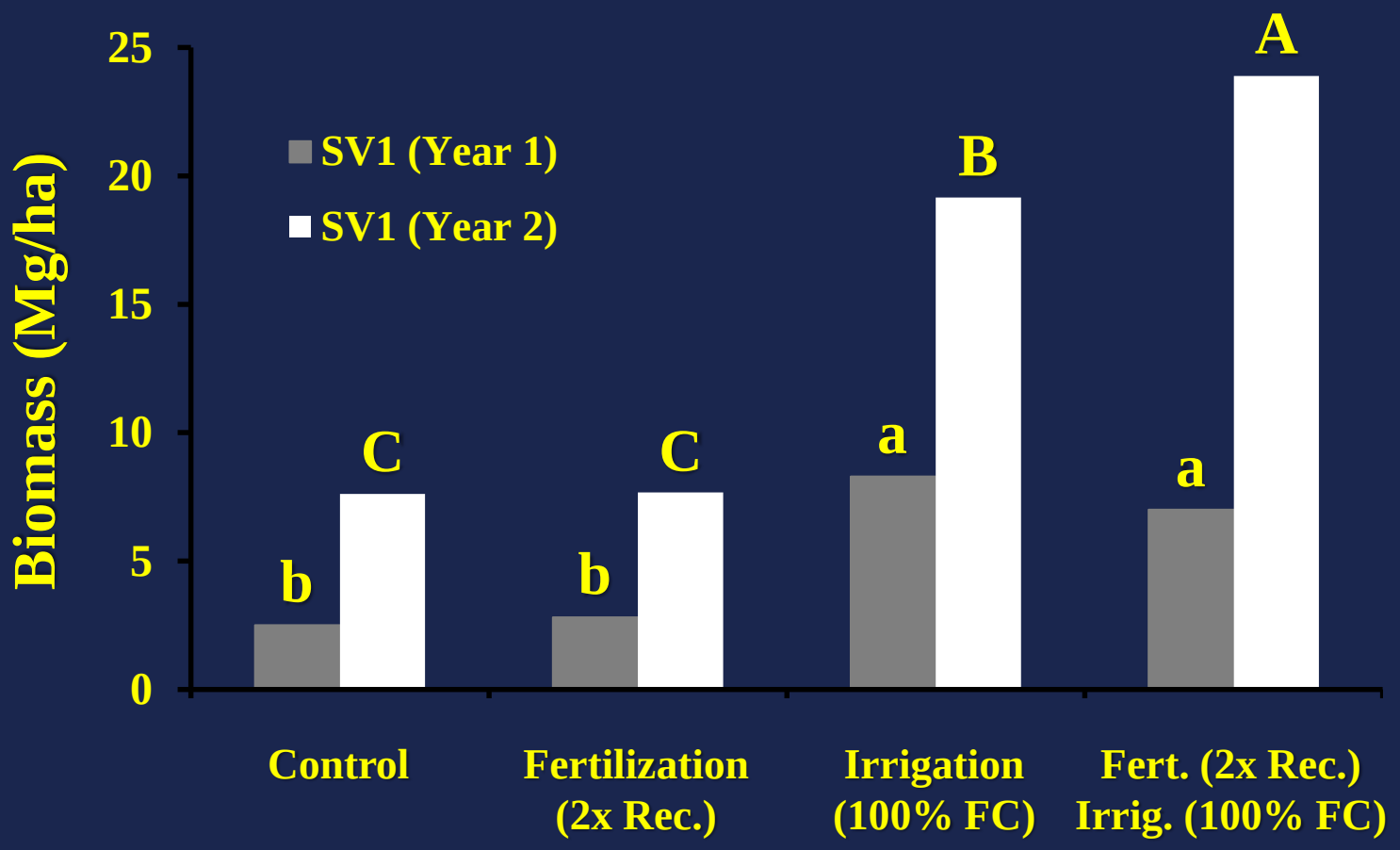


*Mean (n = 3) effect of irrigation and fertilization on above-ground biomass production of the willow clone 'Charlie' after two growing seasons**



**For each year, bars with the same letters are not significantly different (P >0.05) using LSD.*

*Mean (n = 3) effect of irrigation and fertilization on above-ground biomass production of the willow clone 'SV1' after two growing seasons**

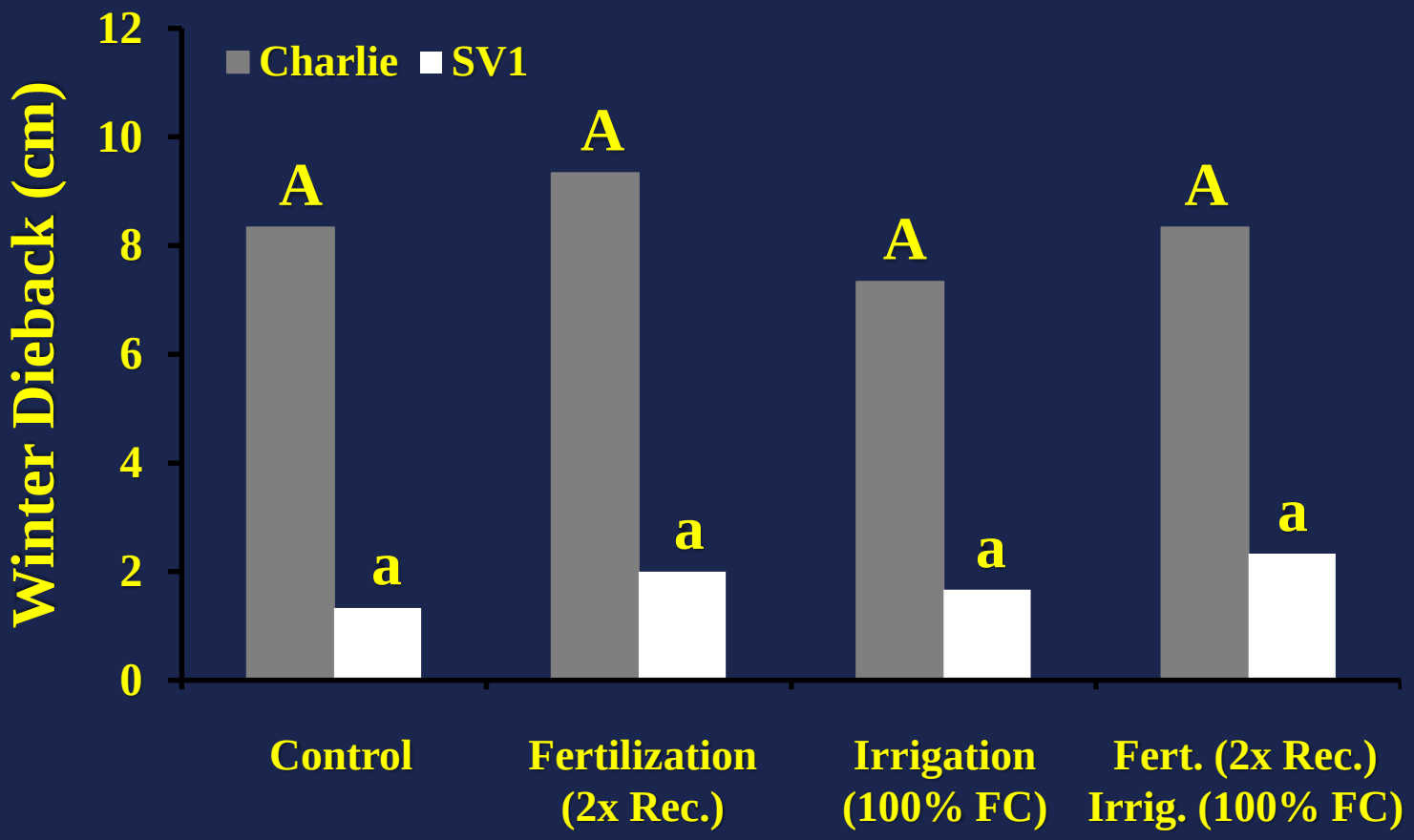


**For each year, bars with the same letters are not significantly different (P >0.05) using LSD.*

Cold Hardiness

October 10, 2009

*Mean (n = 3) effect of irrigation and fertilization on the cold hardiness of willow clones 'Charlie' and 'SV1' after the first winter**



**For each year, bars with the same letters are not significantly different (P >0.05) using LSD.*

Conclusions

- *After two growing seasons, there was a highly significant (P <0.0001) growth response to irrigation. Highlights the importance of water in the semi-arid climate of Saskatchewan.*
- *No significant (P >0.05) fertilization or fert x irrig effects, except for the clone SV1 at the 2x Rec. rate (possibly due to soil type and/or poor FUE).*
- *10 Mg/ha/yr yield is possible when irrigating high-yielding clones on fertile soils.*
- *Future work: harvest (fall 2010); biomass and wood quality assessments; nutrient and water budgets.*

1140 mm (45”) annually, yikes!!!
Where Does the Water Come From?!?

C8 BUSINESS TheStarPhoenix.com Saskatoon, Saskatchewan Tuesday, October 27, 2009

Willow-filtration system promoted for Regina

❑ Trees used to treat wastewater, then burned to generate green energy

By Bruce Johnstone
Saskatchewan News Network

REGINA — Political pundits have long suggested that hot air generated by the debates in the legislative assembly should be used to heat the Legislative Building.

Here’s a twist: How about turning the city’s sewage into green energy and using that to heat the Marble Palace? A company from the Emerald Isle wants to do just that.

Rural Generation Ltd. of Derry, Northern Ireland, is proposing to plant up to 24 million willow trees on 4,000 acres of land near Regina to treat the city’s effluent and generate green energy from the biomass produced.

One of the byproducts of burning wood chips harvested from the plantation is hot water that could be used to heat SIAST’s Wascana campus, or even the Legislative Building, proponents say.

The project, if it gets the go-ahead from city hall, would put Regina on the map in terms of green energy-waste water treatment projects, said John Gilliland, chair of Rural Generation.


Gilliland

“If we pull this off, this will be the largest project of its type anywhere in the world,” Gilliland said in an interview during a recent visit to the city.

Gilliland, who started growing willows in Northern Ireland 15 years ago, said willows work wonders in turning treated waste water into biomass.

“Why willows? Because they’re quick growing. Second, their physiology — in other words, the structure of the plant — allows you to harvest them on a regular basis and they regrow again from the same root. And the last reason, they love water.”

Willows act as an “environmental filter” that can consume two million to four million litres of waste water per acre. “The so-called pollutants in the water are actually fertilizer for the trees,” Gilliland said.

The willows even filter out the sewage smell. In fact, willows can grow one metre or more in a year, allowing them to be harvested after three years and burned in special furnaces that can turn the biomass into hot water, or even electricity.

Gilliland, who was appointed by former British PM Tony Blair to the country’s Sustainable Development Commission in 2005, said there have been similar, albeit smaller-scale, projects in Europe, but never one this size.

Claire Kirkland of the Regina Regional Opportunities Commission (RROC) said the City of Regina will be “challenged” to meet new federal waste water requirements and would have to make “significant investments” to improve the existing treatment system.

Land-based treatment offers some advantages over conventional methods, Kirkland added.

“It may be less expensive, it produces biomass that has value and provides a carbon offset.”

(REGINA LEADER-POST)

Many Thanks!!!!!!

Government of Saskatchewan

NSERC CRSNG

CFS CANADIAN FOREST SERVICE


Questions?